GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

B. Tech Degree Examinations, June – 2021
(Sixth Semester)

BMEPC6020 – DESIGN OF MACHINE COMPONENTS
(Mechanical Engineering)

Time: 2 hrs   Maximum: 50 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions)   **(1 x 10 = 10 Marks)**

Q.1. Answer *ALL* questions   [CO#]   [PO#]

a. A sliding bearing which can support steady loads without any relative motion   CO1   PO1
between the journal and the bearing is called

(i)zero film bearing   (ii)) hydrodynamic lubricated bearing

(iii) boundary lubricated bearing   (iv) hydrostatic lubricated bearing

b. If Z = Absolute viscosity of the lubricant in kg/m-s, N = Speed of the journal   CO1   PO1
in r.p.m., and p = Bearing pressure in N/mm^2, then the bearing characteristic
number is

(i)$\frac{ZN}{p}$ (ii)$\frac{Zp}{N}$

(iii)$\frac{Z}{pN}$ (iv)$\frac{pN}{Z}$

c. The listed life of a rolling bearing, in a catalogue, is the   CO1   PO1

(i)   minimum expected life   (ii)maximum expected life

(iii)average life   (iv)none of these

d. The ratio of hoop stress to longitudinal stress in thin-walled cylinders is   CO2   PO2

(i)1   (ii)1/2

(iii)2   (iv)1/4

e. In a thick cylinder under internal pressure, the radial stress across the thickness   CO2   PO3
of the cylinder is

(i)zero at outside and maximum at   (ii)minimum at outside and maximum
inside   at inside

(iii)uniform throughout   (iv)unpredictable

f. The centrifugal tension in belts   CO3   PO2

(i)reduces power transmission   (ii)increases power transmission

(iii)does not affect power   (iv)increases power transmission upto
transmission   certain speed and then decreases

g. Interference is inherently absent in the following types of gears   CO3   PO3

(i)Involute   (ii)Stub

(iii)Cycloidal   (iv)Epi-cycloid

h. A flywheel absorbs energy during those periods of crank rotation when the   CO4   PO1
turning moment is greater than the resisting moment. The absorption is

(i)at constant speed   (ii)accompanied by increase in speed

(iii)accompanied by decrease in   (iv)not concerned with increase or
speed   decrease in speed

i. In 4-stroke engines, the connecting rod is subjected to variable loading,   CO4   PO3
changing from (in each cycle)

(i)compression to tension   (ii)zero to tension

(iii)zero to compression　　　　　　　　　(iv)none of the above

j. In a steam engine, piston rod and connecting rod are connected by　　　　CO4　　PO1
   (i)gudgeaon pin　　　　　　　　　　(ii)piston pin
   (iii)crank pin　　　　　　　　　　(iv)cross head

PART – B: (Short Answer Questions)　　　　　　　(2 x 5 = 10 Marks)

Q.2. Answer *ALL* questions　　　　　　　　　　　　　　　　　　[CO#]　[PO#]

a. What is meant by hydrodynamic lubrication?　　　　　　　　　　　CO1　　PO1

b. A metal pipe of 1 m diameter, contains a fluid having a pressure of 1 N/mm^2. If the　CO2　　PO2
   permissible tensile stress in the material is 20 N/mm^2, find the thickness of the metal
   required for making the pipe.

c. What is the function of a safety valve fitted in a boiler?　　　　　　　CO2　　PO1

d. What is meant by creep of a belt and what is its effect?　　　　　　　CO3　　PO2

e. What are the various stresses induced in a connecting rod?　　　　　　CO4　　PO3

PART – C: (Long Answer Questions)　　　　　　　(6 x 5 = 30 Marks)

Answer *ANY FIVE* questions　　　　　　　　　　　Marks　[CO#]　[PO#]

3. A journal bearing, 100 mm in diameter and 150 mm long carries a radial load of 7 kN　(6)　CO1　PO2
   at 1200 rpm. The diametral clearance is 0.075 mm. Find the viscosity of the oil being
   used at the operating temperature, if 1.2 kW power is wasted in friction.

4. A shaft rotating at constant speed is subjected to variable load. The bearings supporting　(6)　CO1　PO2
   the shaft are subjected to stationary equivalent radial load of 3 kN for 10 % of time, 2
   kN for 20 % of time, 1 kN for 30 % of time and no load for remaining time of cycle. If
   the total life expected for the bearing is 20×10^6 revolutions at 95 % reliability, calculate
   dynamic load rating of the ball bearing.

5. An air receiver consists of a cylinder, closed by hemi-spherical ends as shown in Fig.1　(6)　CO2　PO3
   It is subjected to an internal pressure of 4.5 MPa. The storage capacity of the receiver is
   0.25 m^3. The permissible tensile stress of the material is 85 MPa. Neglecting the effect
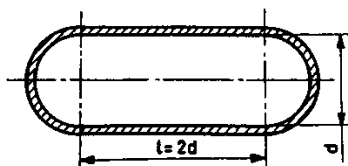   of welded joints, determine the dimensions of the receiver.

Fig.1

6. A spherical shell of 3.6 m diameter and 10 mm thick, is subjected to an internal　(6)　CO2　PO3
   pressure, p. Suggest the value of internal pressure, for preventing failure of the shell,
   according to (i) maximum normal stress theory and (ii) maximum shear stress theory.
   The elastic limit in simple tension is 240 MPa, Poisson's ratio is 0.3 and factor of
   safety is 2.5

7. A belt drive has an angle of lap of 160⁰ on the smaller pulley. The angle of lap is increased to 200⁰, by using an idler. The slack side tension is same in both the cases and the centrifugal tension is negligible. By what percentage, the torque capacity of the belt drive is increased by adding the idler? Use the coefficient of friction $\mu=0.3$. (6) CO3 PO3

8. The following data relates to a screw jack: (6) CO3 PO3

   Load = 20 kN

   Nominal diameter of the screw = 40 mm

   Pitch of the screw = 6 mm

   Coefficient of friction between the screw and nut = 0.15

   Assuming that the load rotates with the screw, determine the torque required to raise the load

9. A flywheel of mass 2000 kg is keyed to a shaft, 100 mm diameter. The shaft drives rollers for rolling the plates. During operation, each plate takes 1.5 sec to pass through the rollers: while the speed drops from 80 rpm to 60 rpm. The radius of gyration of the flywheel is 0.75 m. Determine the torque necessary, shear force on the key, and shear stress induced in the shaft. (6) CO4 PO3

10. Explain the procedure for designing of an overhung crankshaft. (6) CO4 PO2

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